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GENERAL

The Air Tractor AT-802 or AT-802A is an all-metal cantilever low-wing monoplane designed especially for agricultural or fire fighting operations. It is powered by a Pratt & Whitney PT6A turboprop engine which is highly suited for this type of flying. The standard engine for the fire-fighting versions is the PT6A-67AG which is rated at 1350 SHP at sea level and 99° F. The PT6A-65AG is a popular optional engine, which is rated at 1295 SHP. Other PT6A engines are optional, including the PT6A-67F which is rated at 1424 SHP.

The propeller is a Hartzell five-blade constant speed prop with reversing capabilities. The -65 series engines have a 115-inch diameter prop and the -67 series have a 118-inch prop. The hopper is made of fiberglass. It has a capacity of 800 U.S. gallons for Ag versions and 820 gallons for fire-fighting versions. The horizontal stabilizer is all metal and strut-braced for added rigidity. The vertical fin is cantilevered. The elevators and rudder are of all-metal construction and sealed to prevent chemical entry. The fuselage features removable skin panels for ease of maintenance and cleaning. High-lift flaps are incorporated to provide short take-off and landing distances.

Certification Basis

The AT-802 or AT-802A is structurally certified to meet the requirements of FAR 23. The engine installation along with the systems and equipment meet FAR 23 requirements except in cases deemed inappropriate for intended operations. In these cases placards are installed on the instrument panel which prohibit flying under those special conditions. The AT-802 and AT-802A are certified by the FAA for a gross weight of 16,000 pounds.

Certification basis is FAR 21.25. Airworthiness requirements of FAR 23 were met with certain sections excepted as inappropriate for the special-purpose use of agricultural and forest and wildlife conservation. For more information on the certification basis see FAA Type Certificate Data Sheet A19SW.

Instructions for Continued Airworthiness (ICA's)

Maintain the airplane in accordance with the following manuals and documents:

LIST OF MANUALS AND DOCUMENTS

Owner's Manual - Air Tractor Model AT-802 and AT-802A- Agricultural and Fire-Fighting Airplane"
Manual 10011-OM

Air Tractor Inc.
Municipal Airport
P.O. Box 485
Olney, Texas 76374 U.S.A

"Propeller Owner's Manual & Log Book"
Manual 139

Hartzell Propeller Inc.
One Propeller Place
Piqua, Ohio 45356-2634 U.S.A

"Maintenance Manual - Turboprop Gas Turbine Engine-Models PT6A-45A/-45B/-45R"
Manual Part No. 3027042, Vols. 1 & 2

Pratt & Whitney Canada
1000 Marie-Victorin
Longueuil, Quebec
J4G 1A1 Canada

"Maintenance Manual - Turboprop Gas Turbine Engine - Models PT6A-65AG/65AR/65B/65R"
Manual Part No. 3032842, Vols. 1 & 2

Pratt & Whitney Canada
1000 Marie-Victorin
Longeuil, Quebec
Canada J4G 1A1

"Maintenance Manual - Turboprop Gas Turbine Engine - Models PT6A-67/-67A/-67R/-67AF/-67AG/-67T"
Manual Part No. 3036132, Vols. 1 & 2.

Pratt & Whitney Canada
1000 Marie-Victorin
Longeuil, Quebec
Canada J4G 1A1

"Maintenance Manual - Turboprop Gas Turbine Engine - Models PT6A-67F"
Manual Part No. 3071152, Vols. 1 & 2.

Pratt & Whitney Canada
1000 Marie-Victorin
Longeuil, Quebec
Canada J4G 1A1

FAA TCD A19SW

AILERONS

The ailerons are of all-metal construction and hinged on ball bearings. The bellcranks and pushrod ends operate on ball bearings, producing smooth operation and low system friction. The stick forces are light and the ailerons are very responsive. The light stick forces are a result of the installation of aerodynamic servo tabs installed on the outboard end of each aileron.

Each aileron has a large balance weight on the outboard end of the aileron just forward of the leading edge. These weights must never be removed as they are necessary for flutter prevention.

AIR CONDITIONER

The AT-802 airplane uses a gas-cycle air-conditioning system for climate control. This versatile air conditioning system allows the pilot to select ram air from outside, or to re-circulate cockpit air, or a combination of the two. The ram-air control handle is located on the aft-cockpit wall, to the right-hand side of the pilot.

The Sanden SD-508 compressor has five reciprocating pistons driven by a rotating wobble-plate. It uses reed-type valves to control flow at the suction and pressure ports. Mechanical power to drive the compressor is taken from an engine accessory drive pad. Gears in the engine drive a splined-quill shaft that turns a small poly "V" groove pulley. This small pulley drives the larger flywheel pulley with a poly "V" belt. This larger drive pulley is connected, through an electromagnetic clutch, to the compressor shaft.

The wiring schematic for this air-conditioning system is shown in Figure 4. The air conditioner fans, blowers, and compressor clutch are powered by the airplane bus. All control switches for the air conditioning system are located on the pilot's panel. The pilot can use the switches to turn the system ON or OFF and to control the cockpit-blower speed as HIGH, MED, or LOW.

The air conditioner master switch (A/C Switch) enables all functions of the air conditioner system. This switch may be used to select air-conditioning with blower-forced air circulation without air-conditioning.

The Blower Switch controls the speed of the evaporator blower. The blower is ON any time that the A/C Switch is not OFF. Its speed is controlled HIGH, MED, or LOW with the Blower Switch.

The Trinary Switch, located atop receiver/dryer, does two things to control electrical power to the compressor clutch. A set of contacts in the Trinary Switch protects the compressor by opening the Compressor Clutch circuit any time the system's high pressure is less than 25 psi. This same set of contacts open when the system's high pressure exceeds 350 psi.

The functional layout of this air-conditioning system is shown in Figure 3. Referring to Figure 3, in operation, hot, high pressure, gaseous refrigerant leaves the pressure port of the compressor and goes directly to the upper inlet of the condenser coil. While in the condenser coil, the refrigerant is cooled at the high pressure. The temperature drop in the condenser coil causes the gas to liquefy. The refrigerant emerges from the bottom of the condenser coil as a warm liquid under high pressure.

Next, the receiver/dryer acts as an accumulator to dampen pressure pulses from the compressor. The receiver/dryer also removes moisture from the system, preventing internal freeze-up of the expansion valve.

The flow of the warm liquid is directed to the cooling unit. This unit consists of an expansion valve, evaporator coil, and an electrically-powered fan.

The expansion valve throttles the flow of warm liquid, dropping its pressure and transforming it to a cold, saturated vapor.

The cold gas proceeds from the expansion valve to the evaporator coil where it is warmed by removing heat from the air that is forced through the coil by an electric fan. This cooled air is directed to the pilot.

The refrigerant leaves the evaporator coil as a warm gas. The gas flow from the cooling unit is returned to the suction port of the compressor where the compressor raises its pressure and temperature. The hot gas leaves the pressure port of the compressor and the process starts over again.

COCKPIT

The AT-802 or AT-802A has exceptional visibility on the ground as well as in the air. The windshield is three-piece, the two corner pieces being Plexiglas while the flat center piece is automotive safety-plate glass. Cockpit entry is made through either of two large canopy doors. A wire deflector is incorporated into the windshield support structure. The cockpit layout and details are shown in Figures 5, 6, and 7.

The rudder pedals may be adjusted on the ground by removing the T-pin and sliding the rudder pedals in the aluminum channel to the desired position and reinserting the T-pin.

The seat is fixed in one vertical position at the factory. However, the operator may raise or lower the seat if desired by removing the two pins and resetting them in the factory pre-drilled holes. The seat structure is of welded 4130N tubing, oiled internally, and sand-blasted, primed, and painted. The covers are removable and may be changed as required. The covers are of a coarse mesh material for comfort during hot weather. A special installation tool is required for installing new covers and may be borrowed from the local Air Tractor dealer. At the bottom extreme seat bucket, a tubular structure supports a thick Ensonite seat pad.

A three inch-wide-safety belt is attached to the seat structure. The shoulder harness is attached to the primary fuselage structure behind the cockpit. The shoulder harness is a necessary part of the restraint system and must always be worn.

If the aircraft is equipped with AmSafe Airbags, these airbags are built into the shoulder harnesses. The airbag system is equipped with its own internal battery, so it is always active. There is no pilot action necessary to arm or operate the system. The airbag system requires the use of the installed crotch strap for proper pilot protection.

The control lock is located under the instrument panel. It hinges up to engage the tang on the control stick, effectively locking the aileron and elevator surfaces.

The instrument panels are in two sections, with the upper panel containing the instruments most often used during flight. A large hopper window between the panels allows the pilot to determine the amount of dry fertilizer or seed remaining in the hopper. The instruments are described individually in Section 1, INSTRUMENTS.

A stall warning horn is provided. The stall warning lift detector, on the left-hand wing, is set to activated the horn at approximately 5 miles per hour above stall. A hopper quantity gauge is installed on the right-hand side of the upper instrument panel. This gauge is marked to read in U.S. gallons with the aircraft in switch-selectable ground attitude or flight attitude. In addition, hopper quantity gauges are located above each bottom loading valve, at the lower side of the fuselage, where they are visible to ground crew.

The hopper window in the rear wall of the hopper is supported by an aluminum frame. It is sealed with PS890 B-2 sealer that is impervious to most chemicals and is available through Air Tractor dealers.

The cockpit has aluminum enclosure skins and control push-rod boots that insolate the cockpit from the rest of the aircraft and prevent the entry of most chemicals. If the aircraft is to be used for dusting, special modifications are required. See the Airplane Flight Manual for complete instructions on dust applications and modifications.

COCKPIT HEATER

The heater system taps bleed air off the compressor sections of the engine and routes it to an ON-OFF valve on the left-hand side of the fuselage just forward of the cockpit. This valve may be actuated by pulling up on a cable marked HEAT located below the left side of the pilot’s seat and routed through the cockpit floor.

On the aft side of the valve a line is routed to the diffuser which is located on the cockpit floor on the R/H side. The amount of heat desired may be regulated by pulling the valve partially open or fully open.

To limit power loss in the case of line failure to the valve, the Bleed Valve Outlet Fitting that attaches to the compressor case has a ‘Choke” welded to the mounting plate. The “Choke” limits the diameter of the compressor tap to .250 inches.

The cockpit heater is very effective even in the coldest conditions and is a requirement for those operators who have winter work.

CONTROL SYSTEMS

Aileron and Elevator Controls

Push-pull tubes are used in both the aileron and elevator system. Rod-end bearings are installed in each push-rod to minimize control system friction. The torque tube mounted on the cockpit floor is supported at each end with bearings. These bearings have grease fittings so that grease may be applied as necessary. As these bearings wear, fore and aft slack may develop. This slack can be removed with the addition of shims made of .010-inch-thick steel. These shims are added to the forward end of the torque tube. The stops for the elevator control system are located on each side of the elevator horn. The aileron control stops are welded to the cockpit-floor structure at the forward end of the torque tube. Both the aileron and the elevator down stops employ neoprene washers that act as shock absorbers for the system.

Rudder Controls
The rudder controls consist of stainless-steel cables that are connected between the rudder pedals and the rudder-control horn. The rudder stops are located at the rudder horn. There is a spring loaded interconnect system between the rudder and the aileron systems that eases turn coordination. This interconnect also allows banking the aircraft with rudder application alone.

The layout of the rudder-control system is shown in Figure 9.

DISPERSAL SYSTEM

The layout of the Ag dispersal system is shown in Figure 10. The standard spray system includes two and one-half inch stainless plumbing and streamlined extruded aluminum booms. Forty-eight nozzles are incorporated although the boom is drilled and tapped for an additional 48 nozzles if desired. Quick-couplers are used to remove the booms and pump from the aircraft in minutes. The spray pump is an Agrinautics p/n 65715 three-inch capacity pump. The fan is a Weath-Aero F200-144 with adjustable blade angles. The control valve is an Agrinautics p/n 75501 and the strainer is an Agrinautics p/n 4196H30. The bottom-load valves are Transland three-inch p/n 24445 and 24446.

All hoses used in the spray system have a special lining which is impervious to nearly all chemicals. The hoses are double clamped at all connections with stainless-steel worm-drive clamps. All plumbing parts have beaded ends to provide secure hose attachments.

Spraying Systems Inc. spray nozzles are p/n 4666 diaphragm check valve, p/n 1/8 QJJ body, and p/n Qvv-4010 spray tips. The aircraft is equipped with 4010 spray tips for medium volume applications. For high volume spraying, larger spray tips should be installed. If this does not provide the required flow rates, the pump may be changed to a Transland 4-inch pump. With this pump and with 96 nozzles installed with larger spray tips, flow rates on the order of 300 gallons per minute are possible at pressures of approximately 30 psi. See Report 1117.

The boom pressure gauge is part of the dispersal monitoring system. Nylon tubing is used to connect the boom pressure gauge to the boom through the lower fuselage skin.

The fan brake lever is an industrial over-center type lever that has considerable leverage to stop the optional Micronair fan instantly. The brake-cable tension can be adjusted in the cockpit by rotating the brake lever handle. The Weath-Aero fan does not require a brake.

Micronair rotary atomizes may be installed if desired. The factory supplies a special boom for 12 atomizers.

For dry materials, a Transland p/n 22358 extra-high-volume spreader is used. For rapid changeover from spray to dry materials, remove only the pump and booms. The gate box adapter is fitted with a flapper valve to prevent fertilizer from getting into the bottom load tube. For extended fertilizer application it is suggested that the center boom assembly and control valve be removed to prevent fertilizer from getting into the valve assembly. This can be accomplished in only a few minutes by removing the stainless T-pins that support the center boom assembly and removing the bolts that attach the valve to the stainless bracket.

The Air Tractor features a near-leak-proof hopper lid that allows full liquid loads to be carried. The leak-proof feature is made possible by a sturdy over-center latch assembly and a curved hopper top that allows the hopper lid to be pulled solidly into place. Stainless-steel over-center clamps positioned on the fore-and-aft edges of the hopper lid assist in providing the near leak-proof feature. Medium-density nitrile 3/8” x 1” - wide strip is used for the hopper lid gasket.

The hopper vent tube is welded 3” diameter stainless-steel tubing inside the hopper. A 3” diameter stainless ball is used to seal the overboard vent when the liquid level reaches the top of the hopper. The vent tube protruding from the adapter box sides are made of aluminum. They can be rotated to point forward to provide positive pressure in the hopper for dry material application. This slight pressurization in the hopper requires a little less gate opening for a given poundage which reduces the blockage effects of the door opening into the slipstream. When the vent tube is rotated to point aft, a slight negative pressure is created inside the hopper which prevents any fumes from escaping around the hopper lid gasket.

An optional spreader is the Transland 54401 NorCal Swathmaster. It requires the p/n 80598-1 adapter box and the 25-inch gate box.

ELECTRICAL SYSTEM

Starter-Generator System

The Lucas p/n 23048-028 250-Amp, 28-Volt starter -generator (SG) is standard in the AT-802 and AT-802A. It uses a p/n 23046-521 QAD mounting kit. The Lucas p/n 23048-02 300-amp, 28-Volt starter-generator is optional.

The starter-generator system produces and controls all electrical power for the aircraft. It works with the system’s batteries and generator-control unit (GCU) to power the electrical buses. All electrical sub-systems receive their power from buses that are fed by the starter-generator system.

Figure 11 shows the schematic for the 250-Amp charging system. The 250-Amp system is a standard part of the AT-802 and AT-802A. Figure 11A shows the schematic for the 300-Amp charging system. This system is optional but is required when the computer-controlled fire gate is installed. The system consists of:

(1) The Starter/Generator (S/G) - the armature is continuously engaged in the engine’s accessory gear box. The S/G functions as an electric motor for starting the engine and then as an engine driven DC Generator.

(2) The Generator Control Unit (GCU) - The GCU is located on the right lower engine mount tube.

(3) The Line Contractor Relay (LCR) - Located on the right side of the firewall.

(4) The Start Relay - Located on the right side of the firewall.

(5) The Start Switch (ST SW) located on the Lower Instrument Panel.

(6) The Generator Switch (GEN SW) located on the Lower Instrument Panel.

(7) The Pilots Panel Voltmeter (VM) located on the Lower Instrument Panel.

(8) The Low Voltage Warning Light (LV LITE) located on the Upper Instrument Panel.

(9) 15 Amp GCU Circuit Breaker (15A C/B) located on the lower instrument panel.

Batteries

The three batteries are Teledyne Gill Electric p/n G-246AT. They are wired in parallel for extra cranking power. The Amp-hour rating of the three batteries combined is 63 amp-hours. The batteries are 24- Volt lead-acid batteries. A ground start receptacle is installed on the left-hand side of the lower cowling. An external power supply should be used for starting at any time the batteries have a charge of less than 24 volts. Fully charged batteries should allow the gas generator to peak at about 18% Ng before the Start control lever is advanced to the RUN position. At this high an Ng speed, a cool start is possible which is desirable.

EMPENNAGE

The horizontal stabilizers are all-metal and strut-supported for rigidity. The struts are constructed of streamlined 4130N tubing. The struts have a stainless-steel clevis where the attachment to the stabilizer is made. The clevis is adjustable in order to rig the stabilizers properly with the wing and in a straight line from side to side.

The vertical fin is cantilever and is of all-metal construction. A wire deflector cable, attached to the top of the vertical fin, extends to the top of the canopy where it is anchored.

The control surface hinge bearings have a single stainless-steel ball with a Teflon lining. Long bearing life can be expected without lubrication.

The elevator trim tabs act as servo tabs in addition to providing longitudinal trim for the Air Tractor. Because of the large tab size, the trim tabs provide a considerable amount of trim authority. Removable bronze bushings are provided at each joint. As the bushings wear, they should be replaced, so that trim tab free play may be kept to a minimum. The all-metal rudder has a servo tab that also serves as an adjustable trim tab.

ENGINE

The Pratt & Whitney PT6A series of engines have been proven to be one of the most reliable power plants available today. The engine is a lightweight, reverse flow, free turbine engine utilizing two independent turbine sections. One section drives the compressor in the gas generator section and the second drives the propeller shaft through a gear reduction box.

Air enters the engine through an annular plenum chamber, passing through a four-stage axial and one-stage centrifugal compressor. In the combustion chamber, fuel mixed with air is ignited. The expanding gasses are directed through the three turbines and out the exhaust ports on opposing sides of the engine.

The standard engine is a Pratt & Whitney PT67AG turboprop engine for fire-fighting versions. This engine is rated at 1350 SHP for take-off at sea level and 99° F. Maximum torque at take-off is 4170 ft-lbs. Maximum ITT for take-off is 800° C. Maximum Ng is 104% for take-off. Maximum Np for all operations is 1700 RPM. See the flight manual for other engine limits and special conditions. Optional engine for FIREBOSS 802s is the PT6A-67F, (torque 4400 ft-lb, ITT 870° C, RPM 1700, NG 104%).

The standard engine for the Ag models is the PT6A-65AG (Torque 4000 ft-lb, ITT 820° C, RPM 1700, NG 104%). For long engine life it is recommended that the ITT is kept well below the maximum limits. Use only enough power on take-off to operate safely from the strip being used.

Read the engine maintenance manual for instructions as to the care and servicing of your engine. Refer to “Instructions for Continued Airworthiness” in Section 1 of this manual.

Induction System

Engine air is drawn in through the inlet scoop, through a barrier type filter and into a sealed plenum which is located between the forward and aft engine firewalls. There are three different filter installations that Air Tractor has used on AT-802/802A aircraft. Each of these filter installations is over 99% efficient and cause only a negligible pressure drop due to the ram air pressure developed by the air scoop.

The earliest air filter system used two large, cylindrical commercial truck filters. These filters are Donaldson p/n P181047 (alternate is P510336). Aircraft equipped with the Air Tractor Ram Air system have the airscoop moved from the lower side of the engine cowling to the nose of the aircraft, just below the propeller. This Ram Air configuration may have one of two different filter systems. The first system uses a pleated filter element made by Donaldson (p/n 52427-16) pleated filter element. This filter looks like a paper element filter, but is actually synthetic. The second type of Ram Air filter is a Brackett foam air filter. This filter is a disposable foam element filter that contains a sticky residue “wettant” that traps and holds dirt and debris. This is a lightweight, flexible filter that is installed in a stainless steel frame inside the engine plenum. The part number for the Brackett foam filter is BA-413E.

A pressure differential switch is installed on the top R/H side of the aft firewall with one probe in the engine area and the other probe in the plenum. At such time that the pressure difference between the air in the engine area and the air in the plenum is 18 +/- ½ inches of water for the PT6A-67AR/-67R/-67F engines, 15 +/- ½ inches of water for all other engines, the air filter light on the instrument panel will come on. This light has a "push to test" feature and should be checked before the engine is started.

Exhaust System

The exhaust pipes are Air Tractor p/n 51238-7 (L/H) and p/n 51238-6 (R/H). These pipes are attached with stainless MS20034-1 bolts, MS20500-428 nuts, and AN960C416 washers. There are exhaust covers provided with each aircraft and these covers should be installed when the engine has cooled.

ENGINE CONTROLS

A quadrant on the left-hand side of the cockpit incorporates the Power lever, the Propeller control lever, and the Start control lever. The Power lever has an idle stop and cannot be moved into the reverse range without moving the trigger at the top of the lever forward. Do not allow the power lever to be moved into the reverse range unless the engine is running or else the control linkage could be damaged.

The Start lever has a latch that prevents inadvertent movement below the RUN position that would shut off the fuel in flight. The Start lever should always be in the FLIGHT IDLE position during flight to allow the engine to remain spooled up enough during approach to allow quick acceleration in case a go-around is required. Refer to the Start Procedures in the Flight Manual for proper positioning of the Start lever when starting. It is important to remember that only with the Start lever full back at the most aft stop position is the fuel cut off.

The Propeller lever may be placed in the full forward position during the start sequence for more convenient movement for the Start lever providing the temperatures are warm. For cold weather starts the Prop lever should be aft, as called out in the starting instructions, as initial oil pressure will go to engine bearings instead of the propeller dome.

All engine controls utilize ACCO push-pull cable assemblies. These cable assemblies are p/n 66-3651-2021 and have very little friction and require no lubrication. See Figure 13 for the layout of engine controls.

FCU MANUAL OVERRIDE

The fuel control manual override lever is red and is located on the aft cockpit skin on the pilot's left. This lever may be used to modulate engine power in the event of a malfunction in the fuel control pneumatic system. It is intended for emergency use only and **MUST BE OFF** for all normal engine operations. In the case of an emergency, the power lever control must be in the maximum forward thrust position to enable manual modulating of power via the fuel control manual override lever.

CAUTION

The fuel control manual override does not duplicate the normal fuel control functions and is not to be used as an optional means of controlling the engine. It is intended for emergency use only. Using the manual override lever results in the overriding of all automatic control features associated with the normal usage of the power control lever.

FIRE RETARDANT DISPERSAL SYSTEM (FRDS)

The AT-802's Fire Retardant Dispersal System (FRDS) uses state-of-the-art electronic controls and hydraulic power. The FRDS uses a programmable computer to control the hydraulically powered release system.

Two hopper tanks provide a total of 820 gallons capacity for fire retardant. Additionally, an optional 18-gallon foam tank and pump allow the mixing of surfactant or other additives to liquid in the hoppers.

The programmable FRDS computer may be set at its control panel for the precise release of hopper contents. This computer monitors several conditions such as liquid level, g's, hydraulic pressure, and dump door position. Then, at the pilot's command, it sends signals to the system's hydraulic controls to initiate a programmed release of fire retardant. The computer monitors the preset parameters and makes minor adjustments of the door position during the drop. Finally, when the drop is complete, the doors return to the closed position. When the computer senses a drop in the accumulator pressure, it starts the hydraulic pump to recharge the accumulator pressure, it starts the hydraulic pump to recharge the accumulator in preparation for another programmed drop.

The hydraulic system is pressurized by an electrically driven pump. When the system is turned ON, the pump charges a hydraulic accumulator to the desired pressure and the motor is turned OFF. When the system is armed and fired, the accumulator discharges high-pressure fluid into the rotary actuator, moving the doors to an open position. Following the drop, the system is reset for the next drop.

Control Panel
The electrical schematic diagram for the FRDS is shown in Figure 14. When the aircraft master relay is energized, electrical power is available at the Control Panel.

The Control Panel illustration in Figure 15 shows the configuration of the control panel's controls and displays. The numbers shown in parenthesis below correspond to the items in this illustration.

The input values that are necessary to properly operate the system are ground speed (9), gallons to dump (5), and coverage level (3). The control panel displays those settings for coverage level (4) and gallons to dump (6). The ground line display (8) shows the length of the coverage area that is calculated using the selected ground speed, coverage level, and gallons to dump.

Other control panel displays show the hopper quantity (7), and foam tank quantity (15).

Hydraulic system displays shown on the Control Panel illustration include hydraulic pressure gauge (12) and low-pressure warning light (13).

The system is turned ON and OFF with the system master switch (2). The system is armed for release with the arming switch (10). While the system is armed, the ARMED warning light (11) will be lighted green. The panel also has a dimmer (14) for the panel's display lights.

Manual Override Operation (For models s/n 802-0066 and subs.)
Manual System Descriptions: (For models s/n 802-0066 and subs.)
The reliability of the retardant delivery system has been increased by adding a separate manual control system to allow the pilot to manually control the servo-hydraulic system that operates the gatebox doors in the event of a failure in the automatic system computer of associated sensors. An additional computer has been added to handle the control functions necessary to provide the separate manual control system.

When in normal mode, the pump and servo supply solenoid valve (supplies hydraulic oil to the servo system) are controlled by the normal system computer. When the manual system is being used, the pump and the servo supply solenoid are controlled by the manual system computer.

A manual control panel has been added below the normal system pilot interface panel. The operation and function of the switches and indicators are outlined below.

Power Switch - This switch located on FRDS pilot interface. When this switch is set to "Auto" the automatic delivery system is powered and the system is operated as described in the normal operation section. To activate the manual system, the switch should be set to the "Man" position and the power light on the manual panel will be illuminated. To turn power to the hydraulics off, the switch should be set to the "OFF" position.

Run Pump / Close Gate Switch - This toggle switch runs the pump to charge the accumulator when moved to the down position and closes the doors when moved to the up position. In the event of a pump failure detected by the manual system computer, toggling the switch down will reset the pump error and the pump will run until the pressure reaches 3000 psi or a pump error is detected again. If the run pump switch is held continuously, the pump will run as long as the switch is held. This allows the pilot to override the fault detected by the manual system computer to manually run the pump.

Caution
Be sure that the system has sufficient hydraulic oil before using the RUN PUMPSWITCH. The pilot has the ability to destroy the pump motor using this switch since the systems error checking features are disabled by this switch. Never depress this switch for more than one minute continuously since the pump motor may overheat (One minute on, 3 minutes off- maximum duty cycle).

Arm Switch - This 2 position locking toggle switch arms the manual system when in the up position. This switch is only active when the power switch on the pilot interface is set to manual (i.e. automatic computer system not active). No hydraulic pressure can be applied to the manually controlled servo system unless this switch is set to the “ARM” position.

Manual Salvo (or quick dump) - This latching pushbutton (amber lighted) removes power from the auto system, provides power to the manual system, opens the doors and runs the pump for a maximum of 30 seconds when depressed. After this period, the pump and hydraulics are turned off. The light flashes anytime the button has been depressed. The auto or manual system cannot be operated normally when this button is pushed (it has priority). Note that this button works regardless of the position of the pilot interface power switch.

Gate Indicator - This amber light burns steady anytime the doors are sensed as open by the door closed proximity switch.

Pump Fail Indicator - This amber light burns steady when the system has detected a pump problem (in auto or manual mode) and has shut the pump off. In this condition, the pump can still be manually forced to operate using the “RUN PUMP” switch on the manual panel. If the power switch is in the “AUTO” position and a pump fail has been detected by the auto computer, the indicator will be steadily lit. If the power switch is in the “Man” position, the indicator will flash to indicate that a pump error has been detected by the manual system computer.

The Computer
The computer is identified in all references in this manual as the Programmable Logic Computer (PLC). The computer receives the pilot’s input and performs all the calculations required to make a programmed dump.

The computer constantly monitors a number of system parameters, such as g’s, head pressure, quantity fire retardant, and hydraulic pressure. When a drop is initiated by the pilot, the computer executes a group of time-based equations that control the size and time of the opening of the dump doors.

The computer has a smart feature that ensures that drop calibration is maintained with each drop. Following each drop, the computer measures the quantity of material in the hoppers and compares this value to what should have remained in the hopper after the drop. If necessary, the time-based equations are automatically altered to maintain calibration. This prevents drift of the set points over long periods of system use.

The computer also performs other diagnostic functions to be certain that the system is healthy and capable of proper delivery of the fire retardant. When the control panel master switch is turned ON, the computer monitors system hydraulic pressure and turns the pump OFF if certain conditions have not been met. This protects the pump from damage that would result from running it dry.

Hydraulic System
The hydraulic schematic diagram is shown in Figure 17. The hydraulic system is designed to operate at 3000 psi. It uses an electrically powered pump to move fluid from the fluid reservoir to the accumulator for storage. The pump will run approximately 45 seconds to fill a completely discharged accumulator. The normal replenishment time following a drop is 18 seconds.

The hydraulic pump is equipped with a check valve to prevent reverse flow of fluid when the pump is OFF. It also has a pressure relief valve to ensure that system pressure does not exceed 3200 psi. This valve will be active in the event that the system's pressure transducer fails to signal the computer to stop the pump when 3000 psi has been attained.

There are two fluid filters in the system. The low-pressure filter is located between the fluid reservoir and the pump, on the suction side of the system. The high-pressure filter is located between the pump and the accumulator.

The one-gallon accumulator holds a nitrogen precharge of 1650 psi. Two programmed dumps may be executed with a fully charged accumulator.

When a drop is initiated with the trigger switch, the supply solenoid opens, allowing pressurized hydraulic fluid to flow from the accumulator to the servo valve. The servo valve shuttles between the CLOSED - and - OPEN positions, supplying fluid to the rotary actuator in response to commands from the computer. The servo valve also opens a route for the displaced fluid to return to the fluid reservoir.

System Component Description - The hydraulic system is composed of several major components. The moto-pump combination, solenoid valves, accumulator, pressure limit switches, filter, servo valve, fluid reservoir, and rotary actuator are used during normal operation of the system. The components discussed below are numbered for cross reference to the Hydraulic Schematic in Figure 17.

Motor/Pump Combination - The pump assembly consists of a 24-Volt permanent magnet DC motor coupled to a hydraulic gear pump. The hydraulic pump delivers 0.75 GPM at zero pressure and about 0.2 GPM at 3000 PSI. The pump head has an internal high pressure bypass valve set at 3200 PSI that will vent oil flow back to the reservoir to avoid over-pressure of system components in the event of failure of the high-pressure shut-down switch. The older motor-pump combination requires a separate fluid reservoir. The newer motor-pump combination has an integral built-in reservoir. This newer configuration commences with S/N 802-0033.
The motor/pump combination (80577-60) is used to pressurize the accumulator. The pump is able to charge the accumulator in less than 30 seconds.

The pump is switched ON and OFF by the Toshiba programmable logic controller (60501-1). The programmable logic controller (PLC) monitors the hydraulic pressure of the system and turns the pump on (energizes the pump relay (80577)) when system pressure is less than 2850 PSI, and turns the pump off when the system pressure is equal to or greater than 3000 PSI.

Accumulator - The accumulator is a nitrogen charged bladder type accumulator that is precharged with nitrogen to 1650 PSI. Compression of the nitrogen-filled bladder by the hydraulic fluid is used to store fluid power. The normal size of the accumulator is 1 gallon. For an initial oil pressure of 3000 PSI, the accumulator will deliver 58 cubic inches (0.25 gallons) of oil at flow rate of up to 15 GPM before system pressure reaches the minimum design pressure of 1830 PSI.

The accumulator (80577-61) is used to store hydraulic fluid power and discharge high flow rates of fluid when a dump is in progress. This allows the low flow rate hydraulic pump to be used in a system that requires high flow rates for short time intervals. The accumulator also compensates for any expansion of the fluid in the system due to the compliance of the nitrogen.

Servo-Supply-Solenoid-Valve- The servo supply solenoid (80577-71) is a cartridge-type normally-closed solenoid valve. The valve has a 14-GPM rating at a pressure drop of 110 psi.

The servo-supply-solenoid valve is used to turn supply pressure on and off to the hydraulic servo system. Since the servo hydraulics have relatively high null internal leakage flow, this valve is used to stop all leakage until a dump cycle is initiated. When the servo supply solenoid valve is off, the hydraulic pump is able to turn off after the accumulator is charged rather than running a large percentage of the time to make up the null flow lost due to leakage in the servo valve.

This valve is controlled by the PLC and will automatically close in the even of power loss or emergency dump thus assuring that flow to the system is not allowed.

Low-Pressure Filter- The low pressure filter (80577-27) is a standard spin-on type hydraulic oil filter. The 25-micron filter is rated at 20-GPM at a pressure drop of 15 psid.

The low pressure hydraulic filter is placed between the reservoir and the hydraulic pump to catch any large particles that might come from the reservoir before they reach the close tolerance hydraulic gear pump. Since the hydraulic pump delivers a maximum flow rate of only 0.75 GPM and the reservoir is located substantially higher than the hydraulic pump, the filter under normal operating conditions will not cause pump cavitation during the recommended lubrication service interval.

High-Pressure Filter- The high pressure filter is a high pressure cartridge style filter. The filter has 3 micron filtration and pressure drop of only 26 PSID at a flow rate of 30 GPM. The filter has a built-in valve that allows oil to bypass the filter element if the pressure drop across the element exceeds 50 psid.

The high pressure filter is placed between the hydraulic pump and the accumulator to avoid contamination of the extremely close tolerance servo valve. Since the filter will see a maximum flow rate of 0.75 GPM from the hydraulic pump, the filter will not clog under normal operating conditions within the lubrication service interval.

Servo Valve- The servo valve is an electro-hydraulic valve that produces hydraulic oil flow proportional to the voltage sent to the valve's coil. The valve is rated at 10 GPM at a pressure drop of 1000 psi across the valve. The actual flow rate through the valve and actuator can be substantially higher since the valve can have a pressure drop greater than 1000 psid across it.

The servo valve is used in conjunction with a servo control card and a feedback potentiometer to control the position of a rotary actuator. The valve controls the fluid flow to the rotary actuator.

Rotary Actuator- The rotary actuator is a single vane unit with a maximum of 280 degrees of travel and a torque rating of 11,700 in-lb at 3000 psi. The unit produces rotary motion where the angular velocity is proportional to the flow into the actuator and the torque is proportional to the differential pressure across the actuator ports.

The rotary actuator is used to open and close the gatebox doors and is controlled by the servo valve.

Bleed-Solenoid Valve- The bleed-solenoid valve is a cartridge type normally open solenoid valve. The valve has a 4 GPM rating at a pressure drop of 100 psi.

The normally open bleed solenoid is used to vent system pressure when system power is turned off. The solenoid is energized and held closed when system power is applied. Upon loss of power, the solenoid will open and allow system pressure to relieve into the reservoir. This avoids holding high pressure in the system when the system is not in use and automatically dumps system pressure when an emergency dump is initiated.

Emergency-Dump-Solenoid Valve- The emergency-dump-solenoid is a cartridge type normally open solenoid valve. The valve has a 4 GPM rating at a pressure drop of 100 psi. The emergency-dump-solenoid is used to allow free flow between the ports of the hydraulic actuator any time power is off to the system. This allows the pilot to mechanically open the doors without pressure and torque build up in the actuator. For newer systems, beginning with s/n 802-0060, there are two emergency-dump-solenoid valves plumbed in parallel. This provides reliable relief of hydraulic pressure from the rotary actuator during pneumatic emergency dump.

Check Valve- The check valve is a standard reverse-flow check valve that allows oil flow in one direction only. The emergency-dump-hydraulic solenoid will seal in one direction only (i.e. pressure must always be higher on the high pressure port in order to seal). The check valve is used to prevent backflow through the emergency-dump-solenoid while allowing flow in the direction required to open the gatebox doors when the solenoid valve is open. Since the doors are always open during an emergency dump, flow is required in only one direction through the emergency-dump-solenoid and check valve.

Hydraulic-Pressure Transducer- The hydraulic pressure transducer is a stainless steel 5000-psig (15,000-psi burst) pressure sensor that outputs a voltage proportional to the pressure at the sensing port. The PLC monitors the pressure sensor, controls the hydraulic pump motor and displays hydraulic pressure based on the sensed system pressure.

Dump Gate

The dump gate consists of a hopper plenum chamber and a pair of hinged gate doors that are oriented fore and aft beneath the hopper tanks. These doors have watertight seals around their edges. These contain the hopper contents without leakage. The dump gate mechanism is joined to the bottoms of the individual hopper tanks with the hopper plenum chamber that is open at its top to both tanks.

Each of the doors is operated by one of the pair of parallel shafts that run fore and aft through the hopper plenum. The rotary motion of these shafts is synchronized by the mesh of a pair of spur gears that are attached to the forward end of each of the shafts, outside the hopper plenum. A rotary hydraulic motor drives one of the gear and shaft assemblies through approximately 180 degrees of travel. The mating gear and shaft assembly is driven through a mirror image travel of that for the motor driven gear and shaft assembly.

Elbow type linkage arms are attached along the length of these shafts, with the opposite end of the linkage attached to the dump doors. As the shafts rotate through 180 degrees of travel, the elbow linkages move the doors from full closed to full open positions. While the doors are closed, the linkages are in an over center lock position. This ensures that the doors are held closed without hydraulic assistance.

The Foam System

The optional foam tank holds approximately 18 gallons. The system has an operator's control panel and a pump that transfers contents of the foam tank to the hopper tanks for mixing. The panel allows setting the desired amount of foam material to be mixed in the hopper tanks. The wiring schematic for the foam system is shown in Figure 19. The foam control panel is shown in Figure 20.
The foam control panel is located below the FRDS control panel on the left-hand side of the instrument panel. A functional schematic of the foam system is shown in Figure 21.

Normal Operation

When the airplane's master switch is turned ON, the FRDS computer and control panel are powered up. Referring to Figure 15, the hydraulic system is activated when the control panel master switch (2) is turned ON.

All of the quantity and pressure readouts are available with the FRDS control panel master switch (2) turned OFF. Also, all of the programmable settings on the control panel may be made with the control panel master switch (2) turned OFF.

When the control panel master switch is turned ON, the system sensors tell the computer that the hydraulic pressure is low and the hydraulic pump is started. When the system operating pressure is attained, the hydraulic pump is automatically turned OFF.

The number of gallons to be dropped is set with the GALLONS TO DUMP knob on the control panel. The gallons may be set anywhere from 200 to 800 gallons in 50-gallon increments, or MANUAL.

If the MANUAL setting is used, the doors will move full open to the depression of the trigger switch. The doors will remain open so long as the trigger is depressed and snap closed when the trigger is released.

The coverage level is set by the knob (3) and indicated in the window (4). The numbers for the coverage level indicate the distribution in gallons per 100 square feet. Coverage levels from 0.5 to 4.0 may selected in increments of 1/2 - gallon per 100 square feet. SALVO may also be selected. When SALVO is selected, the coverage display (4) will show F.C. for FULL COVERAGE. In the Salvo mode, the dump doors will move to the full open position and remain there until the programmed amount of material has been released.

With the hydraulic pressure up and the desired program entered in the computer, moving the ARMED switch (10) to the ARMED position will prepare the system to perform the programmed drop. The ARMED warning light comes ON.

The drop is initiated by pressing the trigger switch on the grip of the pilot's control stick. This signals the computer to open the supply solenoid. High-pressure fluid flows to the servo valve. The servo valve, in turn, meters high-pressure hydraulic fluid to the rotary actuator that operates the dump doors. System parameters are monitored through the drop to allow fine setting of the door opening. Then, the doors are snapped closed to end the drop cycle.
Following the drop cycle, hydraulic pressure is restored and the system is readied for another drop. The program may be changed or left as is for the next drop.

Manual Operation
The manual dump option is located on the manual section of the FRDS pilot interface. When the manual dump button is depressed, automatic control of the dump gate is overridden. Pressurized hydraulic oil is immediately directed from the accumulator to the rotary actuator, opening the gate doors fully.

Emergency Operation
In the event of failure of either the hydraulic or electrical power systems, the hopper contents may be jettisoned in an emergency. The manual dump button is depressed and the Emergency Dump lever is pushed forward to reliably release all material in the hopper tank.

The Emergency Dump lever is located on the left-hand side of the seat, on the floor. When the Emergency Dump lever is pushed forward, two additional operations occur which will ensure the immediate dumping of the contents of the hoppers in the event that the initial manual dump was unsuccessful. Simultaneously, the parallel shafts and their elbow joints are rotated to break the over-center lock of their linages, and the emergency dump solenoid is de-energized to release the hydraulic lock of the rotary actuator. This release allows the rotary actuator to turn freely. The weight of the hopper load on the doors causes the doors to fall full open and drop the contents of the hopper.

When the Emergency Dump lever is pulled back to its original position after the emergency dump sequence, power to the control system will be reestablished and the doors will close. If either hydraulic or electrical power is unavailable, the doors cannot be closed following emergency dump. The airplane may be landed normally with the hopper doors open without danger of ground contact or adverse aerodynamic disturbance.

FLAPS

Extra large Fowler-type flaps are incorporated on the Air Tractor. The flaps are electrically operated and may be stopped at any position from 0° to the maximum of 30° travel. The flaps are controlled by a switch conveniently mounted just below the throttle quadrant. The flaps have external markings which may be viewed from the cockpit with each mark being 10° of travel.

The flaps are very effective for both take-off and landing. For a short take-off roll, 10° of flap is normally used. The flaps are also useful during turns, although generally less than 10° is used.

FUEL SYSTEM

Standard aircraft have two fuel tanks with a capacity of 127 U.S. gallons each for a total of 254 gallons. Both tanks gravity feed into a small header tank which is located behind the chemical hopper and between the wing rear spar attach parts. Optional fuel capacities are 308 gallons or 380 gallons.

The fuel valve handle is located within easy reach of the pilot and is marked MAIN and OFF. There can be no tank selection since both tanks are interconnected. The fuel valve is placarded in GALLONS USABLE. This is due to the fact that the fuel tank sender does not allow the last 4 gallons to be gauged. The fuel gauge receiver, which is located on the instrument panel, is marked in fractions of usable fuel.

Finger strainers of coarse wire mesh are located in each fuel tank. Fuel flows from the wing tanks into the header tank, through the fuel valve and to the airplane firewall. From the firewall, a fuel line is connected to a large fuel filter. A vacuum pressure switch is connected to the outlet side of the filter. If the filter becomes clogged, the switch will close and the “FUEL FILTER” warning light will illuminate in the cockpit.

The fuel lines continue from the firewall mounted fuel filter to the airframe pump, which is mounted on an engine accessory drive pad. This pump is an Air Tractor p/n 51076-1, set for CCW rotation.

The fuel lines continue from the airframe pump to the fuel heater body. Lines from that point on are furnished with the engine.

There are five quick drains in the fuel system one in each wing tank, two in the header tank and one in the fuel valve.

Each fuel tank has an overboard vent located near the wing tip. With both tanks completely full, it is possible during flight to vent a small amount of fuel overboard by skidding the aircraft or rolling sharply. A check valve located next to the outboard fuel-tank wall greatly reduces the amount of fuel vented overboard during maneuvers.

Fuel type is called out in the Flight Manual. Fuel System Icing Inhibitor (FSII) such as Prist should be added to the fuel at a rate to provide .06% to .15% of FSII by volume when operating below 40° F. See Figure 22 for details of the fuel system.

Ferry Fuel System Installation
The schematic of the AT-802 fuel system is shown in Figure 22. Diagrams showing the installation of the ferry-fuel are shown In Figure 36. The ferry-fuel system may be installed using Figure 22, Figure 84, and Figure 85 and the step-wise instructions shown below:

1. Remove spray pump by disconnecting coupler at gatebox, disconnect brake cable at pump, disconnect side discharge tube at spray valve and tube support on side of gatebox, and uncouple pump at disconnect on pump strut.

2. Remove the bottom load tube between the gatebox and spray valve. Plug opening in gatebox with furnished plug and tighten clamp

3. Install screen per Note 5 of Figure 36 in the gatebox opening that supplies pump. Install coupler, fittings and filter per Figure 36. Assemble all fitting with PR-1422-A2. If filter was used previously, disassemble and inspect for contamination. Safety the coupler arm with Trap per drawing.

4. Remove inspection cover from lower belly skin and route hose from fuel filter through hole to plugged side of fuel valve. Hose must clear all flight controls.

5. Turn fuel valve pointer to OFF position. Remove plug from fuel valve, install fitting and attach hose.

6. To use hopper fuel, rotate fuel selector handle CCW to second detent past ON position.

Ferry Fuel System Removal
Instructions for removal of ferry-fuel system are given below:

1. Turn fuel valve pointer to off position.

2. Remove hose and fitting at fuel valve and install plug.

3. Replace inspection cover in belly skin. Remove coupler, fittings, screen and filter from gatebox.

4. Remove plug from bottom load tube opening in gatebox and install tube.

5. Install spray pump, spray plumbing, and brake cable in reverse order of that shown in “Ferry Fuel System Installation” above.

FUSELAGE

The fuselage structure is of heliarc welded 4130N steel tubing. All fittings and bushings are also of 4130N steel. Fuselage repairs may be made in accordance with appropriate FAA repair procedures and gas welding is permissible except in the area of the main landing gear structure. Advisory Circular (AC) 43-13-1A provides adequate FAA -approved guidance for fuselage repairs.

The 4130N tubes of the main landing gear support structure are welded with 4130 rod and heat treated for strength. Generally, no weld repairs are allowed in this area unless specifically authorized.

The front section of the fuselage from the rear spar forward and including the engine mount have been oven stress-relieved in order to prevent stress concentrations from the welding operation. For corrosion control, oil passage holes are drilled at the intersections of all tubes and clusters. Hot linseed oil is them pumped into the fuselage frame and drained. This oil adheres to the inside walls of the tubing. The exterior of the fuselage frame is then sand-blasted and painted with two coats of yellow epoxy paint that is resistant to nearly all chemical action.

The fuselage lower and upper skins are attached to the fuselage frame with stainless screws and nuts. The fuselage side panels are of heavy gauge 2024-T3 Alclad and are attached to stainless Camloc receptacles. This allows the side panels to be removed in minutes, leaving the fuselage frame open for thorough cleaning and inspection. All skins are mounted with clearance between the skin and the fuselage tubing so that chemicals will not collect and cause corrosion.

INSTRUMENTS

Instruments provided with the basic airplane include a sensitive altimeter, airspeed indicator, ITT gauge, oil temperature gauge, oil pressure gauge, torque-meter, propeller tachometer, gas generator tachometer (Ng), compass, boom pressure gauge, and fuel gauges. A Volt-Ammeter is used with the fire-fighting versions while a Voltmeter is used for the Ag versions.

All of the instruments are equipped with eyebrow lights for illumination in low-light conditions. The light intensity is controlled by the instrument-light potentiometer on both panels.

Altimeter
The sensitive altimeter consists of an aneroid bellows that drives the two hands on the instrument face to indicate pressure altitude. The small, adjustable dial in the face of the altimeter is called the Kollsman window. It indicates the sea-level pressure that corresponds with the altimeter reading. This dial can be adjusted with the knurled knob on the bezel of the altimeter case.

The altimeter is a direct-reading instrument that senses static pressure at the static pressure ports on either side of the aft fuselage of the AT-802A. The static ports of the AT-802 are on the surface of the boom style pitot static tube.

Boom Pressure Gauge
The boom-pressure gage is a Bourdon-tube-driven instrument that indicates actual gage pressure in the spray booms. The pressure is taken from a tap in the center boom section.

Airspeed Indicator
The airspeed indicator is an aneroid-driven instrument that displays the indicated airspeed of the airplane. The instrument contains two aneroid bellows that are used to compare the total pressure at the pitot tube with the static pressure at the airplane's static ports. The result of this comparison yields the pure dynamic pressure obtained by subtracting the static pressure from total pressure. This dynamic pressure is used to drive the hand on the face of the dial with divisions shown in miles per hour or knots.

Compass
The magnetic compass is a direct-reading instrument that senses the azimuth difference in airplane heading and a bearing to magnetic North. This difference is displayed at the lubber line of the compass as magnetic heading.

The compass is swung at the factory and a card is attached that shows the compass error at cardinal headings. The compass deviation is measured with radios and lights OFF. Operation of lights, radios, or other electrical equipment may cause significant error in the compass.

Fuel Gauges
The fuel gauges indicate the fuel quantity in each of the wing tanks. The input signal to the gauges allows the reading of fuel quantity in both the left-hand wing tank and the right-hand wing tank. The gauges do not display total fuel quantity.

Each fuel gauge is a micro-Ammeter that displays Amperage signals from potentiometers that are attached to float arms in the fuel tanks. The faces of the gauges are calibrated in divisions that show fuel quantity in fractions of the FULL reading. The wiring schematic for the fuel gauges is shown in Figure 28.

Low Fuel Warning Light System
AT-802 and AT-802A aircraft, beginning with s/n 802-0072 are equipped with a low fuel warning system. This system consists of a pair of float switches, one mounted in the inboard end of each wing tank. The switches are wired in parallel to a single caution indicator light located on the upper instrument panel. The schematic for the system is shown in Figure 37.

When the low fuel warning light first flickers on, during straight level constant speed flight, there is approximately 20 minutes total fuel remaining. This 20 minutes will vary depending on aircraft attitude and engine power setting.

ITT Gauge
The ITT gauge shows the temperature of engine gases between the gas-producer turbine and the power turbine. The gauge is independently powered electrically by a series of thermocouples in the engine. The display is calibrated to show temperature in degrees Centigrade.

Gas Generator Tachometer
The gas-generator tachometer shows the rotational speed of the gas-generator (Ng) in terms of percentage of its rated speed. The gauge receives its electrical signal from the gas-generator tachometer generator located on the case of the engine.

Oil Pressure Gauge
The oil-pressure gauge displays engine-oil pressure. The instrument is directly driven by oil pressure from the engine. This oil pressure is translated into linear motion by deflection of a Bourdon tube within the gauge.

Oil Temperature Gauge
The oil-temperature gauge is a direct-reading instrument that presents the engine-oil temperature in degrees Fahrenheit. Power for the gauge is taken from the oil-temperature sensor on the engine.

Propeller Tachometer
The propeller tachometer displays the propeller-output shaft rotational velocity in revolutions per minute (RPM). This direct-reading tachometer receives its signal from the tachometer-generator that is driven by the propeller-output shaft on the engine's output gear case.

Torque-Meter
The torque meter presents a measure of the engine's output torque in pound-feet of torque. As engine torque varies, the helically-ground gears in the planet set cause the planetary-gear carrier to push axially against a piston that is fitted into an oil-fill cylinder. The cylinder is pressurized by engine oil via a tap into the engine-oil galley. This pressurized oil is allowed to escape from the cylinder through a bleed slot in the cylinder wall. As the piston is pushed into the cylinder, it progressively covers more of the bleed slot, restricting oil flow out of the cylinder and raising the oil pressure in the cylinder. This oil pressure, though gauged in psi units, is displayed as pound-feet of torque by the Bourdon tube in the torque meter.

Engine torque-and-operating limits are marked on the face of the torque-meter gauge. These markings represent the true torque limits as converted from psi units as gauged in the torque-measuring cylinder. See the appropriate flight manual for a complete description of the specific engine torque limits.

Volt-Ammeter and Voltmeter
Volt-Ammeter- The AT-802 or AT-802A with the optional 250 Amp electrical system is equipped with a Volt-Ammeter. This dual-scale gauge normally reads generator-output amperage. Voltage may be read by pressing the button on the bezel of the instrument.

This conventional meter reads system Voltage from the airplane's electrical bus.

The Ammeter function of the Volt-Ammeter receives its signal from the precision 50-milli-Ohm shunt in the generator output circuit. The Ammeter measures the Voltage drop across the shunt. This Voltage drop is proportional to the current flowing through the shunt, so the meter displays the current units (Amps) that correspond to the drop in Voltage.

Voltmeter- The AT-802 or AT-802A with the standard 150 Amp electrical system is equipped with a Voltmeter. This conventional meter reads system Voltage from the airplane's electrical bus.

LANDING GEAR AND BRAKES

Landing Gear
Spring type main and tail landing gear are used on the Air Tractor airplanes. This type of landing gear provides a minimum of maintenance, low drag and considerable energy absorption for hard landings. In addition, a smooth ride is provided for operations from rough strips.

The main gear axles are made of 4130N steel, and cadmium plated for corrosion protection. Tapered aluminum shims are used between the axle and the main gear leg to provide the proper camber and toe-in. The main gear wheels are Cleveland p/n 40-279A with a 11.00-12 10-ply rating tire installed. Main wheel tire inflation pressure is 60 psi (unloaded) or 62 psi (loaded).

The tail wheel is a Cleveland 40-140C. A grease fitting provided in the side of the wheel is used to grease the bearings.

The tail wheel tire is 17.5X6.25-6 10-ply rating. Tire pressure is 60 psi loaded or unloaded. The tube is 6.00-6.

The tail wheel fork is of welded 4130N tubing construction and is heat treated for strength. A bronze bushing and a tapered roller bearing are incorporated where the fork enters the tail wheel housing. A tail wheel locking mechanism is provided and the tail wheel may be unlocked by pushing the control stick forward. This lifts the stainless locking pin out of the tail wheel fork and allows the tail wheel assembly to swivel 360° . If during taxi the aircraft tends to steer to the left or to the right with the controls neutral, it is possible to readjust the lock pin position by loosening the 4 screws that attach the lock pin housing to fork housing plate. The lock pin can then be moved in the desired direction and the screws tightened.

Brake System
Brakes are the same, left or right, and are Cleveland p/n 30-210A. The brake cylinders are Cleveland p/n 10-86A. Brake fluid is the conventional red petroleum-base Mil-H-5606A fluid. The brake fluid reservoir is a p/n 411611311A and is mounted on top of the lower instrument panel where the fluid level is always visible. The parking brake valves are Scott p/n 4500A-2. Stratoflex hoses are used from the pressure side of the master cylinder to the parking brake valve and stainless steel lines are routed from the valve to the bulkhead fitting of the master cylinder to the parking brake valve and stainless steel lines are routed from the valve to the bulkhead fitting next to the main landing gear. A high-pressure Stratoflex hose connects the bulkhead fitting to the wheel cylinders.
The schematic of the brake system is shown in Figure 23.

PROPELLER AND GOVERNOR

The propeller used with the PT6A--67AG engine is the Hartzell HC-B5MA-3D/M11691NS five-blade 118” diameter constant-speed with reversing capabilities. The propeller used with the PT6A-65 series engines is the Hartzell HC-B5MP-3F/M11276NS five-blade 115” diameter. The primary propeller governor is furnished with the engine. The over-speed governor is a Woodward p/n 210960 for the -67/-65 and -45R engines. The over-speed governor takes over automatically in case of failure of the primary governor and reduces RPM to 1570 +/- 60 RPM.

WINGS

The wing structure is full cantilever, with the main spar carrying all of the bending loads. Construction is of 2024-T3 Alclad for skins and spar webs. The upper spar cap and the lower spar cap are made of alloy steel for long fatigue life. The wing has a constant chord of 81.4 inches and a span of 59.25 ft. The wing utilizes a NACA 4415 wing section and has 2.5 degrees of washout twist which results in gentle stall characteristics.

The leading edge is extra heavy with a leading edge double bonded internally to minimize denting from bird strikes. Each wing panel has the leading edge divided into five different pieces to allow easy replacement. Universal head rivets are used to facilitate the removal and replacement of leading edge sections.

The fuel tanks are located in the inboard section of the wing and are an integral part of the structure. The closely riveted seams and heavy skins make them burst resistant in the event of a crash. Sealing is accomplished by an application of Product Research PR-1422A2 sealing compound. The inboard end of the wing is sealed against chemical entry and the aileron pushrod has a flexible boot attached to prevent entry of chemical at the pushrod location. A complete wire bundle for night working lights is installed inside every wing during assembly.

Both spar caps are cadmium plated and painted with an epoxy paint for corrosion protection. All other parts inside the wing are treated with Alodine and primed with zinc chromate primer prior to assembly.